PLANT REQUIREMENTS FOR MANUFACTURE OF AUTOMOBILE BATTERIES

DEPARTMENT OF STATE

AGENCY FOR INTERNATIONAL DEVELOPMENT

COMMUNICATIONS RESOURCES DIVISION

Washington 25, D. C.

FOREWORD

This brochure is one of a series of reports resulting from overseas technical inquiries on factory or commercial establishments, operation, management, and engineering. The report is designed to provide only a general picture of the factors that must be considered in establishing and operating a factory of this type. In most cases, plans for actual installations will require expert engineering and financial advice in order to meet specific local conditions.

Mention of the name of any firm, product, or process in this report is not to be considered a recommendation or an endorsement by the Agency for International Development, but merely a citation that is typical in its field.

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The original report was prepared by H. D. Nottingham and Associates, Arlington, Virginia, for the technical aids program through the facilities of the Office of Technical Services, U. S. Department of Commerce.

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This report has been revised and rewritten by Vitro Corporation of America, Washington Branch, 1025 Connecticut Avenue, N. W., Washington, D. C.

For further information and assistance, contact should be made with the local Productivity Center, Industrial Institute, Servicio, or United States Aid Mission.

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Alexandria, Virginia

East Penn Manufacturing Company
Lyons Station, Pennsylvania

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AUTOMOBILE BATTERIES

INTRODUCTION

The purpose of this report is to present basic information for establishing a small plant in a foreign country to produce 12-volt, lead-acid automobile batteries. Batteries of this type can be manufactured in a small plant employing a small labor force, and established with a relatively small initial outlay of capital. Based on total gross sales, such a plant would return a profit before taxes of approximately 24-1/2 percent, which would indicate a reasonably profitable venture.

If it should be desirable to manufacture 6-volt batteries, rather than the currently popular 12-volt type, this could be done in the same plant with approximately a 25 percent decrease in direct material cost and a corresponding decrease in total gross sales.

Once established, opportunities exist for a plant of this type to diversify into related fields such as battery cables, battery cases, industrial type batteries, and reclamation of lead from used batteries, to name a few.

GENERAL ASSUMPTIONS

In order to make reasonably realistic estimates in this report, it is necessary to make the following general assumptions:

1. The costs of the building and general facilities are based on United States prices.

2. Material costs are based on those current in the United States.

3. Labor costs are based on the average for the industry as recently published by the United States Bureau of Labor Statistics.

4. Adequate and suitable water, power, sewerage, and transportation facilities are available at the plant site.

5. This plant operates eight hours a day, five days a week, fifty weeks a year.

6. Although distilled water is used in the actual production of the batteries, all water costs are contained under "overhead", rather than splitting them between "direct materials" and "overhead".

7. Only one battery type -- 12-volt, lead-acid with an ampere/hour capacity of approximately 50 at a 20-hour rate -- is produced.

8. No special provision is made for the training of new personnel. It is assumed that learners' rates are paid in such cases, and that they can be charged under "unforeseen expense".

9. The following items cannot be estimated realistically:

    a. Land value
    b. Distribution and selling costs
    c. In-freight and out-freight
    d. Administrative costs
    e. Taxes

    Approximate values are given for each of these items, with the exception of taxes, for the purpose of completing cost estimates; however, adjustments should be made in accordance with actual local costs.

10. All cost estimates contained in this report are to be adjusted to conform to local conditions. Columns are provided in the tables to facilitate conversion of cost figures to those existing locally.

PRODUCT SPECIFICATIONS

All information and costs contained in this report are based on the manufacture of automobile batteries corresponding to the classifications, ratings, and dimensions specified by the Society of Automotive Engineers, Inc.

PRODUCTION CAPACITY

This plant is designed to produce 500 batteries in a 40-hour work week, which is equivalent to an annual production capacity of 25,000. This capacity can be increased, without the necessity of procuring additional equipment, by working longer hours or adding another work shift.

ADVANTAGES OF A 12-VOLT BATTERY

Today, the 12-volt ignition system has almost entirely replaced the 6-volt system previously used for automotive equipment. The principal reason for this is that a 12-volt battery will deliver the same electrical power as a 6-volt one at one-half the amperage and at only a small additional cost. Figure 1 shows a typical 12-volt automobile battery. This leads to certain definite advantages:

1. Since the battery has fewer plates per cell than the 6-volt type, the plate separation is greater and, consequently, battery life is prolonged because of the lessened possibility of short circuits between plates.

2. Auxiliary electrical equipment such as motors, generators, and alternators have increased life because of the lower current requirements.

3. The windings of auxiliary equipment can be constructed of smaller gage wire, thus decreasing the equipment size and cost.

Figure 1. Typical 12-Volt Automobile Battery

PRINCIPLES OF CONSTRUCTION

The basic 12-volt automobile battery consists of six cells of nine plates each connected in series. Since each cell is constructed to deliver two volts, the over-all battery delivers a total of 12 volts between the positive and negative terminals. Batteries are given capacity ratings dependent upon the ampere hours obtained under specified working conditions. This capacity, the product of amperes times the number of hours the battery can deliver this current, depends upon the rate of discharge. Batteries are normally rated on the basis of 20 hours, so that a 50-ampere battery (an average for automotive service) should deliver a continuous current of 2-1/2 amperes for 20 hours.

Each cell contains a total of nine positive and negative plates cast from a 6 percent antimony - 94 percent lead alloy and coated (pasted) with a paste mixture of lead oxides and sulfuric acid. The positive and negative plates are interleaved and separators inserted between each two plates. These separators are normally thin pieces of first growth Douglas Fir, Port Oxford Cedar, or micrephorous rubber. They must be porous enough to permit free flow of electrolyte, but must not have openings large enough to permit short circuits to result from the branching (treeing) of the lead crystals from one plate to another.

Each cell is enclosed in a hard rubber or asphaltic composition case, the positive and negative groups of plates are attached to the appropriate positive and negative terminal posts, and the top is sealed with a vent hole being provided. Six of these cells are combined in a common case, with the terminal posts connected in series, to form a completed battery. Figure 2 shows a cutaway view of a single cell of a 12-volt battery, and figure 3 some suggested connections between the cells.

MANUFACTURING OPERATIONS

The principal manufacturing steps in a battery plant of the proposed production capacity can be readily carried out in an area of approximately 4,000 square feet. A plan view of such a plant layout, divided into five main manufacturing areas and including the necessary storage, office, and rest-room space, is shown in figure 4. This figure also indicates the materials flow through the plant. The principal operations carried out in each of these manufacturing areas are described briefly in the following paragraphs.

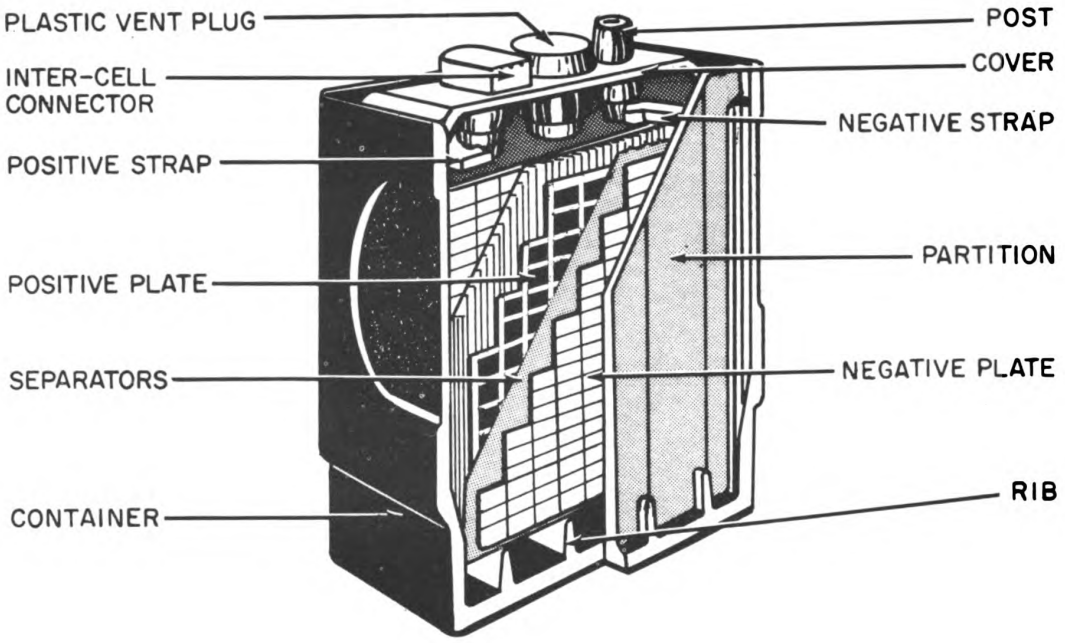


Figure 2. Cutaway View of Single Cell for 12-Volt Battery

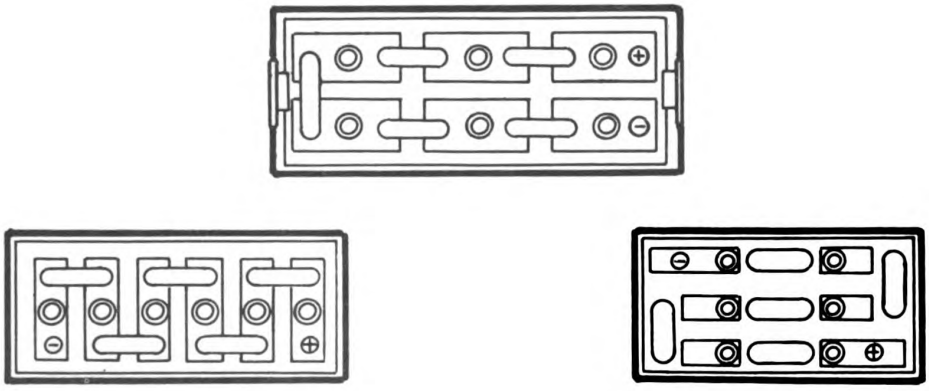
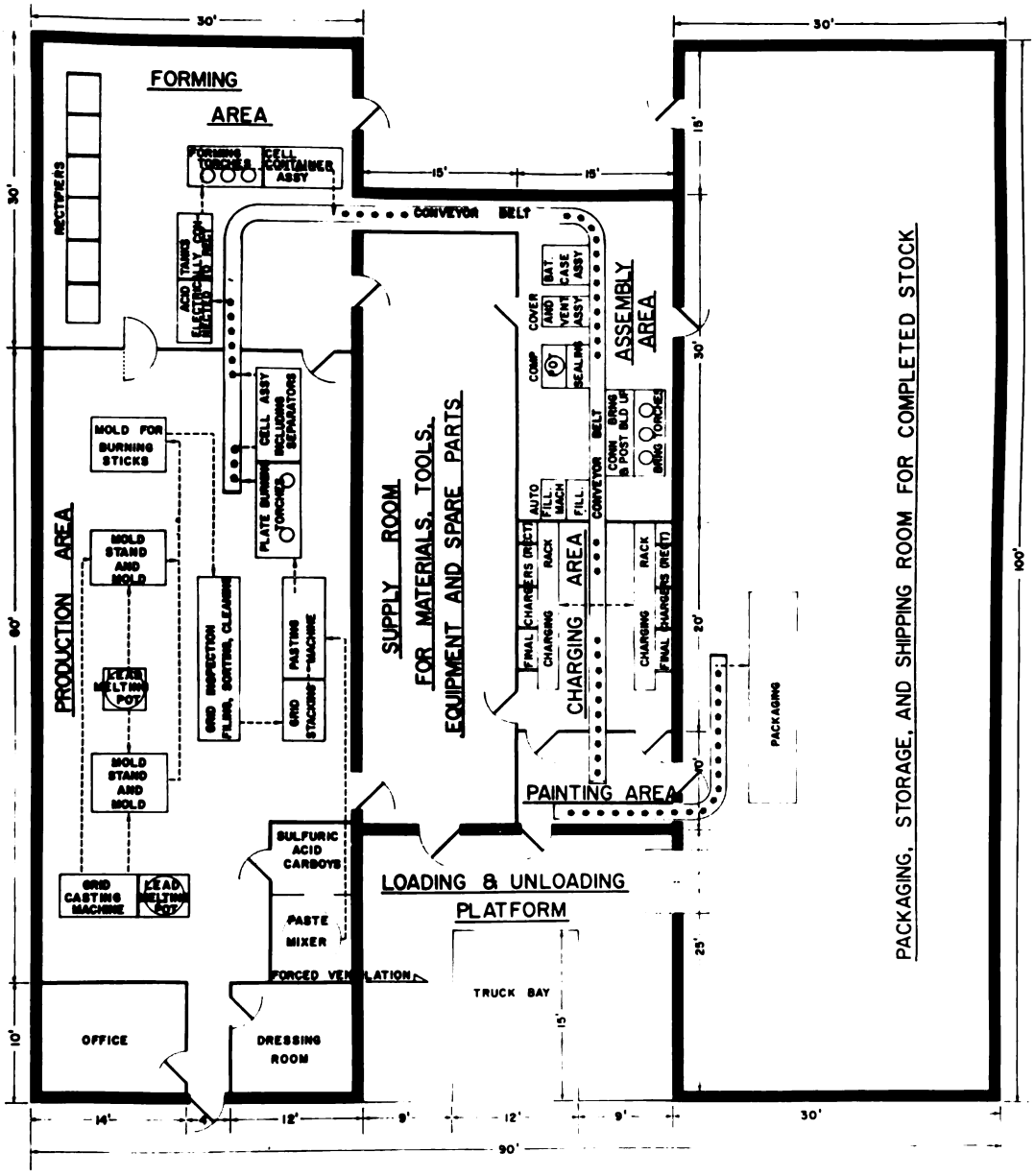


Figure 3. Suggested Arrangements for Connections Between Cells



KEY TO ABBREVIATIONS

ABBREVIATION	MEANING	ABBREVIATION	MEANING
ASSY	ASSEMBLY	COMP	COMPOUND
AUTO.	AUTOMATIC	CONN	CONNECTOR
BAT.	BATTERY	FILL.	FILLING
BLD UP	BUILD UP	MACH	MACHINE
BRNG	BURNING	RECT	RECTIFIERS

Figure 4. Plan View of Typical Battery Plant with Work Flow Indicated

Production Area

Antimonial lead is heated to its liquid state in a temperature controlled melting pot and then cast into grids which form the base for the positive and negative plates. (See figure 5). The grids are then inspected, cleaned, and stacked on the pasting machine. This machine automatically fills the grids with lead-sulfuric acid paste.

From the pasting machine, the grids, which are now called plates, are sent to the burning racks where the correct number to make up the positive and negative plates of a cell are united to common posts. (See figure 6). These positive and negative groups are then interleaved, and a separator placed between each two plates, to form a cell. These cells, minus their cases, are the end product of the production area.

Other small parts, such as connectors, are hand-cast and join the plates for assembly, prior to going to the acid tanks for initial charge. See figure 7.

Forming Area

The basic cells are then placed in a tank containing a weak solution of sulfuric acid, connected in series to the rectifiers, and a direct current passed through them. This operation is continued until the paste on the positive plates is converted to lead peroxide, and the paste on the negative plates is reduced to sponge lead. The cells are then placed into their individual rubber or asphaltic cases and sent to the assembly area by conveyor belt.

Assembly Area

Located along the conveyor belt are several stations where the cells are placed in the outer battery cases, the covers put in place, the unit sealed, the cell connectors burned integral with the posts and lead bushings to make an acid-tight seal, and the terminal posts built up. While still on the conveyor belt, the batteries are machine-filled with sulfuric acid of the proper specific gravity and the vents inserted. The batteries then proceed to the charging area.

Charging Area

The batteries are put on charge until the acid is thoroughly mixed and has attained the proper specific gravity. The normal, fully charged specific gravity for a battery of this type is 1.280 ± 0.010, corrected to 26.70 degrees Centigrade. The batteries are then checked for proper voltage and placed back on the conveyor for removal to the painting area.

Figure 5. Casting of Grids to Form Base for Positive and Negative Plates

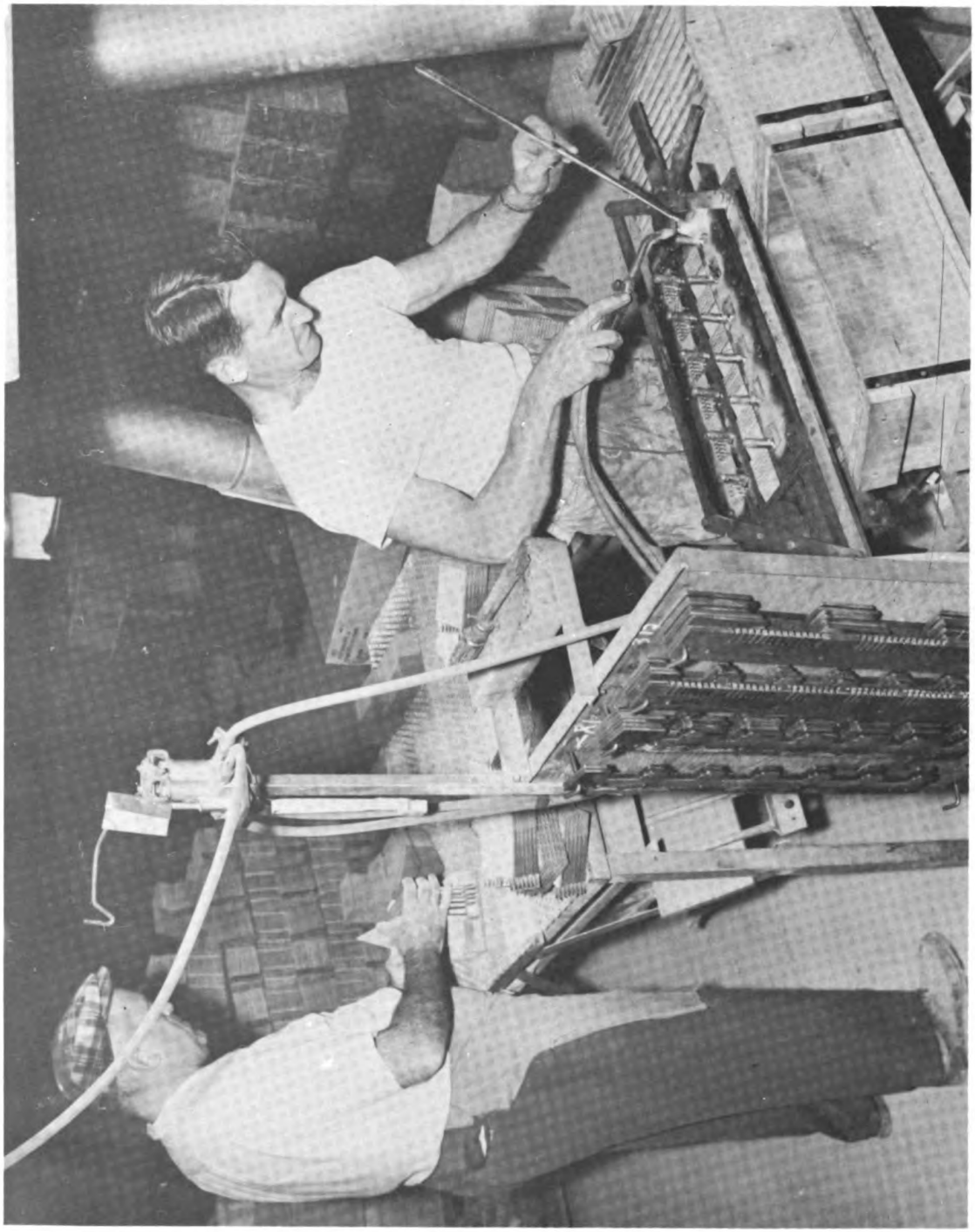


Figure 6. Burning Racks for Assembly of Positive and Negative Plates

Figure 7. Casting of Small Parts Such As Cell Connectors

NOTE: In recent years, so-called "dry charge" batteries have become very popular. To produce batteries of this type, all operations are identical through the charging cycle. After charging, the diluted acid is removed from the battery (See figure 8) after which it is thoroughly steam dryed and sent to the storage room for placement in shipping cartons. Two 2-quart containers of acid are supplied with each battery. Prior to use, the acid is placed in the battery and it is given a quick-charge. Batteries stored in the dry condition have a much longer shelf life than those stored in the wet condition.

Painting Area

After removing any spilled acid and drying the cases, the tops of the batteries are sprayed with black lacquer and the trade mark embossed. If desired, the cases are identified by rolling with various colored stencilling lacquers before proceeding to the packaging and storage area on the conveyor belt.

PLANT SITE

Since this plant uses relatively large quantities of lead and sulfuric acid, both of which are heavy and costly to transport, some thought should be given to locating within a reasonable distance of the sources of such materials. Proximity to good transportation facilities is also desirable, both for shipping the finished product and for receiving the raw materials. As with most industrial plants, this one should not be close enough to residential areas to cause complaints due to the plant exhaust. Finally, the plant should be so located that sources of electricity and suitable water are either available or easily acquired. To allow room for future expansion, about one-third to one-half acre of ground would be required, at an estimated cost of $1,000.

BUILDING

The plan view of a proposed plant layout given in figure 3, indicates overall dimensions of about 90 by 100 feet and a total floor area of approximately 7,800 square feet. The building shown in figure 3 is a one-story, cement or cinder block structure, and the dimensions shown for each of the areas are ample to avoid overcrowding. They might be reduced somewhat, especially in the storage area, if available capital so dictates. The building

Figure 8. Dry Charge Area

as illustrated is estimated to cost a minimum of $31,200, including electrical wiring, gas lines for propane torches, water lines, sewage lines, excavating, foundation, erection, etc.

POWER

The total connected power requirements for this plant are approximately 135 kilowatts per hour. The annual power cost is estimated at $3,600 based on 1.3 cents per kilowatt hour. Even in the United States, power costs vary widely with locality.

WATER

Both distilled and ordinary washing and drinking water will be required by this plant. The total estimated annual cost for both types is $2,000.

FUEL

Fuel oil is required for heating only, and the estimated annual cost is $1,000.

LABOR REQUIREMENTS

The labor requirements to operate a plant of the proposed production capacity are relatively small and can be broken down into direct and indirect categories, as given in the following two tables:

DIRECT LABOR

Occupation	Number Required	Hourly Rate	Annual Cost Estimated	Annual Cost Actual
Caster	1	$2.45	$ 5,000	
Laborers	10	1.75	36,000	
Total	11		$41,000	

INDIRECT LABOR

Occupation	Number Required	Hourly Rate	Annual Cost Estimated	Annual Cost Actual
Manager-Engineer	1	$--	$ 7,200	
Truck Driver	1	1.80	3,750	
Office Clerk	1	1.50	3,100	
Total	3		$14,050	

MATERIALS REQUIREMENTS

The supplies and direct materials given in the following two tables will be required to achieve the estimated annual production capacity of 25,000 batteries. It is essential that the antimonial lead, the lead oxides and the sulfuric acid be of the highest quality. Any compromise in this area will only lead to increased production costs, through equipment damage, and to the production of an inferior product.

SUPPLIES

Item	Annual Cost Estimated	Annual Cost Actual
Maintenance & Repair Parts	$ 300	
Safety Supplies	250	
Office Supplies	250	
Propane Gas	3,000	
Total	$3,800	

DIRECT MATERIALS

Item	Unit	No. of Units	Unit Cost	Annual Cost Estimated	Annual Cost Actual
Antimonial Lead	lb	244,000	$0.18	$ 43,920	
Positive & Negative Oxides	lb	244,000	0.18	43,920	
Sealing Compound	lb	6,250	0.06	375	
Battery Cases	ea	25,000	2.25	56,250	
Sets of Covers	set	25,000	1.00	25,000	
Vents	ea	150,000	0.02	3,000	
Separators	1,000	1,050	12.00	12,600	
Sulfuric Acid	gal	8,350	0.60	5,010	
Shipping Cartons	ea	25,000	0.15	3,750	
Paint	gal	100	3.00	300	
Lacquer	gal	150	4.00	600	
Total				$194,725	

PRODUCTION TOOLS AND EQUIPMENT

Description	Number Required	Estimated Unit Cost	Total Cost Estimated	Total Cost Actual
Casting Machine & Melting Pot	1	$7,200	$7,200	
Pasting Machine	1	7,200	7,200	
Paste Mixer	1	2,900	2,900	
Grid Molds	2	325	650	
Post Molds	2	350	700	
Connector Molds	2	350	700	
Burning Rack	1	150	150	
Charging Equipment (24 batteries)	12	260	3,120	
Burning Torches	8	25	200	
Acid Tanks (4 x 3 x 4 feet)	4	200	800	
Melting Pot for Sealing Compound	1	30	30	
Lead Melting Pot with Burner (1,000 lb)	1	75	75	
Filling Machine	1	780	780	
Paint Spray Equipment	1	100	100	
Total			$24,605	

OTHER TOOLS AND EQUIPMENT

Description	Number Required	Estimated Unit Cost	Total Cost Estimated	Total Cost Actual
1-Ton Truck	1	$2,500	$2,500	
Lift Truck	1	750	750	
Hand Trucks	2	12.50	25	
Skids	20	12	240	
Conveyor Belts	200 ft	2.50/ft	500	
Paint Rollers	2	5	10	
Maintenance Tools			250	
Safety Equipment			250	
Cleaning Equipment			120	
Work Tables & Benches			250	
Incidental Equipment			150	
Total			$5,045	

FURNITURE AND FIXTURES

Description	Number Required	Estimated Unit Cost	Total Cost Estimated	Total Cost Actual
Desk	1	$100	$100	
Typing Desk	1	100	100	
Typewriter	1	150	150	
Filing Cabinet	1	75	75	
Chairs	3	25	75	
Drinking Fountain	1	100	100	
Total			$600	

DEPRECIATION

Description	Estimated Cost	Years Life	Per Year Estimated	Per Year Actual
Building	$31,200	25	$1,245	
Production tools and equipment	24,605	10	2,460	
Other tools and equipment	5,045	10	505	
Furniture and fixtures	600	5	120	
Total			$4,330	

MANUFACTURING OVERHEAD

Item	Annual Estimated	Actual
Depreciation	$ 4,330	
Indirect labor	14,050	
Power	3,600	
Water	2,000	
Fuel	1,000	
Supplies	3,800	
Total	$28,780	

MANUFACTURING COST

Item	Annual Estimated	Actual
Direct materials	$194,725	
Direct labor	41,000	
Manufacturing overhead	28,780	
Total	$264,505	

FIXED ASSETS

Item	Estimated	Actual
Land	$ 1,000	
Building	31,200	
Production tools and equipment	24,605	
Other tools and equipment	5,045	
Furniture and fixtures	600	
Total	$62,450	

WORKING CAPITAL

Item	Estimated	Actual
Direct materials, 30 days	$16,225	
Direct labor, 30 days	3,420	
Manufacturing overhead, 30 days	2,400	
Reserve for sales collections, 30 days	1,000	
Total	$23,045	

CAPITAL REQUIREMENTS

Item	Estimated	Actual
Fixed assets	$62,450	
Working capital, 30 days	23,045	
Total	$85,495	

SALES REVENUE

Based on an annual production of 25,000 batteries valued at $14.53 each, wholesale, the total annual gross sales are $363,130 which yields a gross profit before taxes of 25%.

RECAPITULATION OF COSTS, SALES AND PROFITS

Item	ANNUAL COSTS Estimated	Total	Actual
Direct Materials	$194,725		
Direct Labor	41,000		
Manufacturing Overhead	28,780		
Total Manufacturing Costs		$264,505	
Interest on Loans	1,500		
Insurance	1,000		
Legal Fees	1,000		
Auditing	1,500		
Unforeseen Expenses (Bad Debts, Etc.)	3,000		
Total Administrative Costs		8,000	
Total Sales Costs*		18,000	
Total Business Costs		$290,505	
Profit Before Taxes		72,625	
Total Annual Gross Sales		$363,130	

* Includes Commissions, Travel, Freight-out, Discounts, Etc.

BUDGET CONTROL

A requisition form designed to provide accurate records of procurement and indicate the purpose of procurement with the least amount of time and effort is shown on page 25.

This form has an account number for each type of the various expenditures which the manager will review in detail, monthly or oftener, in order to control his expenses. Some items, such as power and water, are usually under contract and are easily checked by reference to monthly bills. For simplification, items (marked with an asterisk in the table on page 24) are omitted from the purchase requisition. Variations in the labor costs are easily reviewed by examination of the payroll vouchers. The simplified type of control thus provided makes certain that the manager can control expenditures promptly.

In addition to the requisition form, a sample voucher check is shown on page 26. Voucher checks should be used for the payment of all expenditures and the appropriate book account number placed on each voucher.

At the end of each month the manager will receive a statement of all expenditures broken down by budget accounts, as shown on page 24. If the expenditures exceed the budgeted monthly allowances of any of the accounts, the bookkeeper will furnish the manager with a breakdown of all expenditures relative to the budgeted accounts exceeded. All these supporting data can be secured by reference to the purchase requisitions and the check vouchers. This reference will enable the manager to determine what caused the over-expenditure and take corrective action.

If at any time during each month it becomes apparent that expenditures will exceed any of the budget accounts, the bookkeeper will bring this to the attention of the manager for his information and action.

BUDGET CONTROL ACCOUNTS

Account Number	Monthly Expense	Monthly Budget	Annual Budget	Actual
10 Administrative		$ 425	$ 5,000	
20 Sales		1,500	18,000	
30 Direct Materials		16,200	194,725	
40 Supplies		320	3,800	
51 Power*		300	3,600	
52 Water*		170	2,000	
53 Fuel		85	1,000	
60 Unforeseen Expense (Reserve Account)		250	3,000	
71 Direct Labor*		3,420	41,000	
72 Indirect Labor*		1,170	14,050	
80 Depreciation (Reserve Account)		360	4,330	
Total		$24,200	$290,505	

PURCHASE REQUISITION	COMPANY NAME	DATE

☐ 10 ADMINISTRATION ☐ 40 SUPPLIES

☐ 20 SALES ☐ 50 UTILITIES

☐ 30 MATERIALS ☐ 60 UNFORESEEN EXPENSE

INDICATE BELOW THE USE OF MATERIALS

☐ DIRECT MATERIALS ☐ MAINTENANCE SERVICES

☐ MAINTENANCE MATERIALS ☐ OPERATING SUPPLIES

	PLEASE ORDER THESE MATERIALS OR SERVICES	DELIVERY WANTED	
QUANTITY	DESCRIPTION	UNIT	TOTAL

QUOTES FROM		REQUISITIONED BY	
QUOTES FROM		APPROVED BY	
QUOTES FROM		ORDER NO.	ORDER DATE

R. W. MITCHELL MANUFACTURING COMPANY
1422 BOSWORTH STREET, S. E.

65-22
514

ANYWHERE, U. S. A. _____ 19___ No. 10000

PAY _____ DOLLARS $ _____

TO THE ORDER OF

R. W. MITCHELL MANUFACTURING COMPANY

TO FIRST NATIONAL BANK
ANYWHERE, U. S. A.

BY SAMPLE CHECK
VICE PRESIDENT

ACCOUNT NUMBER

Sample voucher check to be used for the payment of all expenditures in connection with Budget Control.

R. W. MITCHELL MANUFACTURING COMPANY

ENGINEERS

The services of professional engineers are desirable in the design of this plant, even though the proposed plant is small.

A correct design is one which provides the greatest economy in the investment of funds and establishes the basis of operation that will be most profitable in the beginning and will also be capable of expansion without expensive alteration.

The addresses of professional engineers who specialize in industrial design, some of whom may be willing to undertake such work on low cost projects overseas, can be secured by reference to the published cards in various engineering magazines. They may also be reached through their national organizations, one of which is the

National Society of Professional Engineers
2029 K Street, Northwest,
Washington 6, D.C.

Manufacturers of industrial equipment employ engineers familiar with the design and installation of their specialized products. These manufacturers are usually willing to give prospective customers the benefit of technical advice by those engineers in determining the suitability of their equipment in any proposed project.

The equipment manufacturers also know, and can recommend, professional engineers in private practice who are willing and able to provide appropriate consulting services.

TRAINING

Manufacturing an inferior quality of product during the training period could create sales resistance that might be difficult to cope with later. To avoid such possibilities, the quality of the product should be maintained at all times, including the training period.

In some areas skilled operators may be available locally. In other areas all the operators may have to be trained.

If skilled operators are not available, adequate training would be assured by using one or more of the following methods:

A. If the plant is designed and installed by a competent engineering firm, the contract should be negotiated, if possible, on a turn-key basis. On this basis the contractor agrees to operate the plant and produce the quality and quantity of the product stated in the contract for an agreed period of time. Such a contract would assure adequate personnel training, since full quantity and quality could not be produced with an untrained organization.

B. The engineering firm that designs and installs the plant can usually make training arrangements to have key personnel placed, for training purposes, in a foreign industry that produces the same type of product. This would provide training for the key personnel while the plant is being installed.

C. If neither of the above methods is possible, then qualified and experienced individuals should be employed for the key positions, either permanently or temporarily, to perform the key operations and assist in training the organization, even if they must be secured outside the country.

D. The manager should have years of successful experience in this type of business and be fully qualified in all phases of management, including the training of employees.

SAFETY

There is always danger of accident and injury in any industrial plant. Because of this, the manager should take specific action to bring to the attention of each employee the importance of safety precautions and intelligent first aid.

Practically all machines have safety appliances, and the manager should see that these are in good working condition and that the operators are making full use of them.

In addition to constant watchfulness to make sure that all practicable safety precautions are taken, first aid supplies should be readily available. One complete first aid kit should be maintained near the manager's office, and others at appropriate places throughout the plant. Some of the employees should be trained to provide first aid service.

The use of accident posters in the plant have proved to be of value in reducing accidents. It is recommended that such posters be used, and that some direct special action be taken by the manager, at least once each month, to bring to the attention of all personnel the importance of safety precautions.

A fire brigade should be established and each member trained as to his responsibility in case of fire. Fire drills should be conducted periodically.

It is recommended that the employees be encouraged to offer suggestions or recommendations relative to prevention of accidents, removal of fire hazards and maintaining general interest in all safety factors.

SUMMARY

A small plant, built and operated according to the assumptions made in this report would be a profitable undertaking.

Provision is made for inserting local cost in connection with all cost figures shown in this report. A careful analysis should be made of all cost figures to determine the local potential profits in any location where such a plant is being considered.

There are some determinations, however, that should be made before a decision is reached to build and operate such a plant.

For example, what are the possibilities of future expansion within the country for this industry?

What other products could be manufactured with the machinery and equipment specified in this report?

Is there a market for such additional products?

How does this industry compare with other industries that may be needed in the country relative to the following factors:

1. The economic value to the country.

2. The needs of the majority of the people.

3. The amount of investment capital required.

Consideration should also be given to such factors as :

The amount of power required and the availability of a dependable supply. If an adequate supply is not available the installation of power equipment may be required.

The water requirements for all purposes including fire protection and potable water for drinking purposes.

The fuel requirements and availability. If local fuel can be used the boiler should be adaptable to such fuel.

The transportation facilities to and from the plant. If they are not adequate an investment in trucks may be required.

OTHER CONSIDERATIONS

There are other important subjects, shown below, that should be fully investigated and considered. Information on these subjects is usually available from such sources as banks, government agencies, exporters and importers, wholesalers, retailers, transportation companies and manufacturers.

MATERIALS AND SUPPLIES

1. Are all materials and supplies available locally?
2. Is the local material market competitive?
3. Is satisfactory delivery of local materials assured at reasonable prices?
4. What materials and supplies must be imported?
5. Are they available in world markets at competitive prices?
6. Would prompt delivery of imported materials and supplies be assured so that large inventories would not be required?

MARKET FACTORS

1. Is there already a demand for the product?
    - A. Who are the principal consumers?
    - B. Who are possible new consumers?

2. How is demand for the product now satisfied?
    - A. By local production? If so, what is the volume of annual production?
    - B. What percentage of consumption is filled by local production?
    - C. By imports? If so, what is the volume of annual imports?
    - D. What percentage of consumption is met by imports?
    - E. From what areas are imports derived?

3. What is the estimated annual increase in local consumption over the next five years?
    - A. How were such estimates made?
    - B. By reference to official figures on population growth, family budgets, imports, etc.?
    - C. By consultation with trade or industry, ministries, associations, bankers, commercial houses, wholesalers, retailers, industrial consumers, etc.?

4. If the product is already being manufactured, can the existing and estimated future local market absorb production of the new plant without price-cutting or other dislocations?

5. Would the estimated sales price and quality of the new product make it competitive with an imported equivalent?
    A. After adjusting cost to local conditions, is the estimated sales price of the product so high that tariff protection is necessary to protect it from imports?

EXPORT MARKETS

1. Could the product compete in export markets on the basis of price, quality and dependability of supply?
2. Can export markets for the product be developed?
3. If so, in what areas and in what annual volume?
4. What procedures would be necessary to develop export markets?
5. What would it cost?

MARKETING PROBLEMS

1. In calculating costs of the product, has adequate allowance been made for the expense of a sales department, advertising and promotion that might be required?

2. Do consumer prejudices against locally manufactured products exist?
    A. If so, why?
    B. Would they apply to the new product?
    C. If so, how could they be overcome and what would it cost to do so?

3. Do marketing and distribution facilities for the product exist?
    A. If not, can they be set up?
    B. What would it cost to do so?

4. Will the product be sold to:
    A. Wholesalers?
    B. Retailers?
    C. Direct to consumer?
    D. Other industries?
    E. Government?

FINANCIAL FACTORS

1. Technical advice on selection of machinery and equipment.
    A. In selecting the machinery and equipment for the new plant, have reputable and competent engineers and technicians been consulted?
    B. Have they been asked for advice on the most suitable types of machinery and equipment for the process and locality?
    C. Have they carefully compared costs of various suppliers?
    D. Credit terms offered purchasers?

FINANCIAL REQUIREMENTS OF THE PROJECT

1. In estimating the cost of the project, has careful consideration been given to:
    A. The effect on costs of delays in construction schedules?
    B. In delivery and installation of machinery and equipment?
    C. In import of essential raw materials and supplies?

2. In calculating cash flow and working capital requirements, has careful consideration been given to:
    A. Maintaining adequate inventories of raw materials?
    B. Supplies and spare parts?
    C. Seasonal fluctuations in the business?
    D. The time required to liquidate credit sales to customers and bad debts?
    E. The period necessary to get the plant into production?
    F. Cash required to amortize its principle loans?

3. If the economy is in a period of inflation, has full allowance been made for the influence of rising prices and wages on the cost of the project and on working capital requirements?

SHORT TERM BANK CREDITS

1. Has it been possible to make arrangements with local banks to finance short-time working capital requirements of the business?

FINANCIAL PLAN

1. Has a definite plan to finance the project been worked out?
    A. Is sufficient capital available locally?
    B. If not, what is the plan to obtain the required capital?

ECONOMIC FACTORS

1. How much foreign exchange (and in what currency) is required to import machinery, equipment and supplies:
    - A. How much foreign exchange (and in what currency) is required for annual interest payments and amortization of any loans contracted to import machinery and equipment, or for payment of royalties and technical services?
    - B. How much foreign exchange (and in what currency) is required for annual import of raw materials and supplies?
    - C. What are estimated annual foreign exchange earnings and in what currencies?
    - D. Has careful consideration been given to the possibility of depreciation in the foreign exchange value of the local currency?
    - E. Has careful consideration been given to the possibility of import controls, or restrictions on availabilities of foreign exchange necessary to operate the business?
    - F. What benefits would the new business bring to the economy in the use of local raw materials: in employment and in technology?
    - G. Do dependable facilities exist for transportation, power, fuel, water and sewage?
        - (1) If not, can existing deficiencies be eliminated satisfactorily?
        - (2) What would be the cost to do so?

PERSONNEL

1. Is there an adequate labor supply near the plant location?
    - A. If not, how can the problem be solved?

2. Can the problem of training competent management and supervisory personnel be solved?
    - A. Also, the training of skilled labor?
    - B. Is technical advice available in the locality?
    - C. If not, where can it be obtained and what will it cost?

LAWS AND REGULATIONS

1. Do existing labor laws, government regulations, laws and taxes favor establishment of new business?
    - A. If not, can existing obstacles be removed?
    - B. If so, how and when?

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TECHNICAL AND TRADE ASSOCIATIONS

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Society of Automotive Engineers, Inc., 29 West 39th Street, New York 18, New York

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